IN THE CLAIMS

1. A laser system comprising:

a laser for providing a laser beam;

a non-linear optical crystal in the laser beam path creating a second order light;

a laser beam expander in the beam path after the non-linear crystal;

a dichromatic mirror in the beam path after the beam expander;

an objective lens that focuses the laser beam on a sample and collects transmission from the sample before the sample transmission impacts the dichromatic mirror;

a partial reflector of the second order light in the transmission path after the dichromatic mirror; and,

a coupler for coupling an optical component to the sample transmission.

2. A laser system as in claim 1 wherein:

the laser is a near IR pulsed laser.

3. A laser system as in claim 2 wherein:

the laser is selected from the group consisting of a Nd:YAG, Nd:YVO_4, and Nd:YLF laser.

4. A laser system as in claim 2 wherein:

the laser is a 1064nm YAG laser pulsed at between 10 to 50Hz with 50 to 100mJ of output.

5. A laser as in claim 1 wherein:

non-linear optical crystal is a frequency doubling crystal.

6. A laser system as in claim 5 wherein:

the frequency doubling crystal is selected from the group consisting of potassium titanyl phosphate, lithium triborate, beta-barium borate, potassium dihydrogen phosphate, potassium dideuterium phosphate, potassium titanyl phosphate, lithium niobate, magnesium oxide doped lithium niobate, and potassium niobate.

7. A laser system as in claim 1 wherein:

the dichromatic mirror is a high reflection mirror at NIR laser wavelengths and high transmission at broad fluorescence range.

8. A laser system as in claim 1 wherein:

the dichromatic mirror allows the second order light to pass through to a detector to provide single pixel wavelength calibration based on the magnitude of the signal of the second order light at this pixel.

9. A laser system as in claim 1 wherein:

the optical component is selected from the group consisting of an eyepiece, a camera, a CCD, a CMOS, a spectrometer, and a fiber optic cable.

10. A laser system as in claim 1 wherein:

the transmission from the sample is caused by the relaxation of a plasma formed at the spot on which the laser is focused.

11. A laser system as in claim 1 further comprising:

a shutter for blocking the fundamental laser frequency of the beam in the beam path between the optical crystal and the beam expander.

12. A laser system as in claim 9 further comprising:

a second shutter for blocking the laser beam in the beam path between the laser and the optical crystal.

13. A laser system as in claim 10 further comprising:

a second non-linear crystal placed between the first optical crystal and the shutter for mixing the fundamental and the second harmonic and generating the third harmonic wavelength.

14. A laser system as in claim 1 further comprising:

a second non-linear crystal placed between the first optical crystal and the shutter for mixing the fundamental and the second harmonic and generating the third harmonic wavelength.

15. A laser system as in claim 1 further comprising:

an attenuator module placed in the transmission path prior to an optical component comprising an attenuator plate, a compensator and a shutter for controlling the energy levels impacting the optical component.

16. A laser induced breakdown spectroscopy system comprising:

a laser for providing a laser beam;

a non-linear optical crystal in the laser beam path for creating a second order light;

a laser beam expander in the beam path after the non-linear crystal;

a dichromatic mirror in the beam path after the beam expander;

an objective lens that focuses the laser beam on a sample and collects transmission from the sample before the sample transmission impacts the dichromatic mirror;

a partial reflector of the second order light in the transmission path after the dichromatic mirror;

a coupler for coupling a first optical component to the sample transmission;

a first attenuator in the transmission path after the partial reflector and before a second optical component; and

a second attenuator in the beam path after the dichromatic mirror and before a power detector.

17. A method of aligning a laser beam on a sample comprising:

providing a fundamental laser beam;

passing the laser beam through a non-linear optical crystal creating a second order light beam;

focusing the second order light beam on a sample while blocking the fundamental beam from the sample; and

providing for the fundamental beam to impact the sample at the point of focus of the second order light beam.

18. A method of determining calibration of a laser comprising:

providing a fundamental laser beam;

passing the laser beam through a non-linear optical crystal creating a second order light beam;

focusing the second order light beam on a detector at a predetermined pixel; and

determining deviation of the second order light from the predetermined pixel for determining the state of calibration.

19. A method of determining the calibration of a laser comprising:

providing a fundamental laser beam;

passing the laser beam through a non-linear optical crystal creating a second order light beam;

passing the second order light through a second non-linear crystal mixing the fundamental and the second harmonic to creating a third order light beam;

focusing the second and third order light beams on a detector at predetermined pixels; and

determining the amount of deviation of the second order light from its predetermined pixel.